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BSI Standards Publication

Thermal insulation products for buildings — In-situ formed loose fill cellulose (LFCI) products

Part 1: Specification for the products before installation

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National foreword

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Thermal insulation products for buildings - In-situ formed loose fill cellulose (LFCI) products - Part 1: Specification for the products before installation

Produits isolants thermiques destinés aux applications du bâtiment - Isolation thermique formée en place à base de cellulose (LFCI) - Partie 1 : Spécification des produits en vrac avant la mise en oeuvre

Wärmedämmstoffe für Gebäude - An der Verwendungsstelle hergestellter Wärmedammstoff aus Zellulosefüllstoff (LFCI) - Teil 1: Spezifikation für die Produkte vor dem Einbau

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Foreword

This document (EN 15101-1:2013) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by March 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This European Standard consists of two parts which form a package. The first part is the harmonised part satisfying the mandate and the CPD and is the basis for the CE marking covering the products, which are placed on the market. The second part, which is the non-harmonised part, covers the installation checks for the installed products.

This European Standard is one of a series for mineral wool, expanded clay, expanded perlite, exfoliated vermiculite, polyurethane/polyisocyanurate, cellulose, bound expanded polystyrene and expanded polystyrene in-situ formed insulation products used in buildings, but this standard may be used in other areas where appropriate.

The reduction in energy used and emissions produced during the installed life of insulation products exceeds by far the energy used and emissions made during the production and disposal processes.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements for loose-fill cellulose insulation (LFCI) products for the thermal and/or sound insulation of buildings when installed into walls, floors, galleries, roofs and ceilings.

This European Standard is a specification for the loose-fill cellulose insulation (LFCI) products before installation.

This European Standard describes the product characteristics and includes procedures for testing, marking and labelling and the rules for evaluation of conformity.

Products covered by this European Standard may also be used in prefabricated thermal insulation systems and composite panels; the structural performance of systems incorporating these products is not covered.

Products with a declared thermal conductivity at 10 °C greater than 0,060 W/(m × K) or a declared thermal resistance lower than 0,25 m^2 × K/W are not covered by this European Standard.

This European Standard does not specify the required level of all properties to be achieved by a product to demonstrate fitness for purpose in a particular application. The required levels are to be found in local regulations or non-conflicting standards.

This European Standard does not cover factory made cellulose products placed on the market as bats, mats or boards intended to be used for the insulation of buildings or loose-fill cellulose products for the insulation of building equipment and industrial installations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 312, *Particleboards - Specifications*

EN 508-1, *Roofing products from metal sheet — Specification for self-supporting products of steel, aluminium or stainless steel sheet — Part 1: Steel*

EN 520, *Gypsum plasterboards — Definitions, requirements and test methods*

EN 1609, *Thermal insulating products for building applications — Determination of short term water absorption by partial immersion*

EN 12086:2013, *Thermal insulation products for building applications — Determination of water vapour transmission properties*

EN 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Products of high and medium thermal resistance*

EN 13172:2012, *Thermal insulating products — Evaluation of conformity*

EN 13238, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

EN 13501-1, *Fire classification of construction products and building elements — Part 1 Classification using data from reaction to fire tests*

EN 13823:2010, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 29053, *Acoustics — Materials for acoustical applications — Determination of airflow resistance (ISO 9053)*

EN ISO 354:2003, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:2003)*

EN ISO 10456 *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO 10456)*

EN ISO 11654, *Acoustics — Sound absorbers for use in buildings — Rating of sound absorption (ISO 11654)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

ISO 12491, *Statistical methods for quality control of building materials and components*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
open blow applications
all applications except cavity applications

3.1.2
declared insulation thickness: "open blow" applications
installed insulation thickness minus the thickness loss according to the settlement class of the product

3.1.3
declared insulation thickness: cavity applications
identical with the thickness of the cavity

3.1.4
floor
horizontal division between two storeys, over a crawl space or a floor directly on the ground

3.1.5
frame construction
walls with wood or metal studs, sloping roof with insulation between and above rafters, as well as stud girders and internal and external insulation on solid masonry construction

3.1.6
settlement
decrease of installed insulation thickness in lofts or height in cavities and frame constructions either under vibration, humidity, cyclic conditions and time, expressed as a percentage of the initial installed insulation thickness (after compaction if required)

3.1.7
coverage
mass of insulation per unit area

3.1.8
performance chart
table giving thickness and coverage requirements for different values of declared thermal resistance

3.1.9
class
combination of two levels of the same property between which the performance is to fall where the levels are given by the declared value of the characteristic concerned

3.1.10
loose-fill cellulose insulation (LFCI)
fibre, fibrous or granulated insulation material derived from paper, paper stock and/or wood, leave or stalk strings with or without binders which are blown, injected or applied with or without moisture

3.2 Symbols

ρ	is the density after settlement testing	kg/m^3
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m^{2}K/W
R_D	is the declared thermal resistance	m^{2}K/W
R_{mean}	is the mean thermal resistance	m^{2}K/W
d	is the declared insulation thickness	mm
W_p	is the short-term water absorption	kg/m^2
α_P	practical sound absorption coefficient	
α_w	weighted sound absorption coefficient	
R_a	is the level of airflow resistivity	kPa s/m^2
S_0	is the height before the settlement tests	mm
s_D	is the mean declared settlement value	mm
S_i	is the mean value of measured insulation height for settlement process number i	mm
s_λ	is the estimate of the standard deviation of the thermal conductivity	W/(m $\times$ K)
$\lambda_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m $\times$ K)
λ_D	is the declared thermal conductivity	W/(m $\times$ K)
λ_i	is one test result of thermal conductivity	W/(m $\times$ K)
λ_{mean}	is the mean thermal conductivity	W/(m $\times$ K)
μ	is the water vapour diffusion resistance factor	
N	is the number of test results	
ρ	is the bulk density before settlement test	kg/m^3
AF	is the symbol for the level of airflow resistivity	
BA	is the symbol for the declared class for resistance to biological agents	
CR	is the symbol for the declared class for corrosion	
SH	is the declared class of settlement for horizontal applications loft and floors	
SC	is the declared class of settlement for cavity insulation, frame constructions and cavity walls	
WS	is the symbol of the declared level for short-term water absorption	

NOTE There are additional symbols in Annex B which are not listed here.

3.3 Abbreviations

— ITT is **I**nitial **T**ype **T**est

— LFCI is **L**oose-**F**ill **C**ellulose **I**nsulation

4 Requirements

4.1 General

Product properties shall be tested in accordance with Clause 5. To conform to this standard, products shall meet the requirements of 4.2 and 4.3 as appropriate.

This European Standard gives an example of a manufacturer's performance chart (declared thermal resistance related to the declared density range) which can be adapted for any application, see Annex K.

NOTE Different applications can require different classes for settlement. One test result of a product property is the average of the measured values on the number of test specimens given in Table 6.

4.2 For all applications

4.2.1 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be based upon measurements carried out in accordance with EN 12667 and/or EN 12939 for thick products and 5.3.2.

The thermal values shall be determined in accordance with Annex A, 5.1 and 5.3.2 and declared by the manufacturer, according to the following:

— the reference mean temperature shall be 10 °C;

— the values shall be measured in dry conditions but the values declared shall be given for the product when conditioned at 23 °C and a relative humidity of 50 % (see 5.2);

— the thermal resistance, R_D, shall always be declared. The thermal conductivity, λ_D, shall be declared where possible;

— the thermal resistance, R_D, and the thermal conductivity, λ_D, shall be given as limit values representing at least 90 % of the production determined with a confidence level of 90 %;

— the measured values shall be expressed to three significant figures;

— the declared thermal resistance, R_D, shall be calculated from the declared thermal insulation thickness and the corresponding $\lambda_{D,}$ taking into account the declared settlement s_D (see NOTE below);

— the value of thermal conductivity λ_D shall be rounded upwards to the nearest 0,001 W/(m × K) and declared in levels with steps of 0,001 W/(m × K); the thermal conductivity value shall be declared;

— the value of thermal resistance, R_D, shall be rounded downwards to the nearest 0,05 m^2 K/W and declared in levels with steps of 0,05 m^2 K/W; since LFCI can be installed at a variety of thickness (e.g. in a void or cavity) a table giving declared R-values at different thickness shall be used for marking and labelling.

NOTE The thermal resistance for loose-fill cellulose insulation is declared by the manufacturer in accordance with the declared density range using thermal conductivity measurements taken at densities across the declared density range and the worst result used as the declared value (see Annex K).

4.2.2 Settlement

4.2.2.1 General

Settlement shall be determined by testing by the appropriate method given in Annex B.

4.2.2.2 Horizontal applications, loft and floors

Settlement shall be classified and declared in accordance with Table 1. The classification shall be based on measurements made in accordance with the laboratory method B.1 given in Annex B (temperature and humidity cycle).

Table 1 — Classes for settlement for horizontal applications, lofts and floors

Class	Requirement
SH 0	No measureable settlement (≤ 1 %)
SH 5	≤ 5 %
SH 10	≤ 10 %
SH 15	≤ 15 %
SH 20	≤ 20 %
SH 25	≤ 25 %
SH 30	> 25 %

4.2.2.3 Cavity insulation, frame constructions and cavity walls

Settlement shall be classified and declared in accordance with Table 2. The classification shall be based on the long-term settlement experience after installation or measurements made in accordance with the laboratory Method B.2 given in Annex B.

Table 2 — Class for settlement for cavity insulation, frame constructions and cavity walls

Class	**Requirement**
SC O	No measureable settlement (≤ 1 %)

4.2.3 Reaction to fire

Reaction to fire classification of the product, as placed on the market, shall be determined in accordance with EN 13501-1 and the basic mounting and fixing rules given in Annex C.

4.2.4 Durability

4.2.4.1 General

The appropriate durability characteristics have been considered and are covered in 4.2.4.2 to 4.2.4.3.

4.2.4.2 Durability of reaction to fire against ageing/degradation

The long-term fire resistance of LFCI does not change with time.

4.2.4.3 Durability of thermal resistance against ageing/degradation

All durability aspects of thermal conductivity are detailed in Annex A. In particular, settlement and change in thickness over time for open blow applications needs to be considered.

4.3 For specific applications

4.3.1 General

If there is no intended requirement for a property, as described in 4.3, for a product in its end-use application, then the property does not need to be determined and declared by the manufacturer.

4.3.2 Short-term water absorption

Short-term water absorption, W_p, shall be determined in accordance with EN 1609, Method A with specimen preparation in accordance with Annex D. Test results shall be classified according to Table 3.

Table 3 — Classes of short-term water absorption

Class	Requirements
WS1	$\leq$ 1,0 kg/m^2
WS 2	$\leq$ 2,0 kg/m^2

4.3.3 Water vapour diffusion resistance factor

Loose-fill Cellulose products have a structure that is highly permeable to water vapour. The water vapour resistance factor, μ, may be assumed to be 1 if no measurements are available. If measurements are undertaken, the product shall be tested in accordance with EN 12086, climatic condition A. Alternatively, values cited in EN ISO 10456 may be used.

4.3.4 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonised test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: *http://ec.europa.eu/enterprise/construction/cpd-ds/*

4.3.5 Corrosion resistance of the insulation material on certain metals

Corrosion resistance shall be classified and declared in accordance with Table 4 after testing in accordance with Annex E.

Table 4 — Classes of corrosion resistance

Class	Requirements
CR	Test passed

4.3.6 Mould fungi resistance

Resistance to mould fungi shall be classified and declared in accordance with Table 5 after testing in accordance with the procedure given in Annex F.

Table 5 — Classes for mould fungi resistance

Class BA	*Intensity of growth in relation to comparative material*
0	no mould visible on specimen surface, examined with reflected-light microscope at 50× magnification
1	mould growth not or hardly visible to the naked eye, but clearly visible at 50× magnification
2	mould clearly visible to the naked eye – considerably weaker than on the comparison material
3	mould clearly visible to the naked eye – equal or more intensive than on the comparison material

4.3.7 Airflow resistivity

The airflow resistivity, r_a, shall be determined in accordance with EN 29053, Method A using specimens prepared in accordance with Annex G. The value of the airflow resistivity shall be declared in levels with steps of 1 kPa s/m^2. No test result shall be lower than the declared value.

NOTE Airflow resistivity can be used when estimating the risk for reduced thermal resistance caused by convection or when evaluating the sound insulation capability.

4.3.8 Continuous Glowing Combustion

Where subject to regulations, the manufacturer shall declare the glowing combustion of the product. In the absence of an existing test method, the compliance with the requirement shall be made on basis of the existing method used in the place of use of the product.

NOTE A European test method is under development and the standard will be amended when this is available.

4.3.9 Sound absorption

The sound absorption coefficient shall be determined in accordance with EN ISO 354 but always without a plenum. The sound absorption characteristics shall be calculated in accordance with EN ISO 11654 using the values for the practical sound absorption coefficient, α_p, at the frequencies: 125 Hz, 250 Hz, 500 Hz, 1 000 Hz, 2 000 Hz and 4 000 Hz and the single number value for α_w (weighted sound absorption coefficient).

α_p and α_w shall be rounded to the nearest 0,05 ($\alpha_p > 1$ shall be expressed as α_p=1) and declared in levels with steps of 0,05. No test result (α_p and α_w) shall be lower than the declared level.

4.3.10 Reaction to fire of product in standardised assemblies simulating end-use applications

Reaction to fire classification of products in standardized assemblies simulating end-use applications shall be determined in accordance with EN 13501-1 with the basic mounting and fixing rules given in Annex J.

This classification offers the opportunity to give a complementary and optional declaration on reaction to fire for standard test configurations of assemblies which include the insulation product.

Detailed information about the test conditions and the field of application of the classification as stated in the reaction to fire classification report shall be given in the manufacturer's literature.

5 Test methods

5.1 Sampling

Sufficient product should be sampled in order to perform all the required tests of the same batch of product.

5.2 Conditioning

For test samples, no conditioning is needed unless otherwise specified in the test standard. In case of dispute, the test samples shall be stored at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 6 weeks prior to testing. For FPC no special conditioning of the test samples is needed.

Except for 5.3.2, test specimens shall be conditioned in an atmosphere of (23 ± 2) °C and (50 ± 5) % relative humidity until stabilisation at constant weight is achieved. Stabilisation is obtained when the relative change in weight does not exceed 0,5 % between two consecutive weekly measurements. In case of dispute, the following stepwise procedure shall be carried out:

— step 1 (dry reference): The specimens are conditioned for 72 h at (70 ± 2) °C, in an oven ventilated with an air taken at (23 ± 2) °C and (50 ± 5) % relative humidity, and then weighed. The mass of the test specimen at step 1 is $m_{23,dry}$.

— step 2 (normal reference): After conditioning according to step 1, the specimens are further conditioned in an atmosphere of (23 ± 2) °C and (50 ± 5) % relative humidity until stabilisation, and then weighed. Stabilisation, by definition, takes at least 6 weeks with some additional time so that the relative change in moisture does not increase by more than 5 % between two consecutive weekly measurements. The mass of the test specimen at step 2 is $m_{23,50}$.

Moisture content, $u_{23,50}$, expressed in kilogram per kilogram, shall be determined by weighing the specimens at each step with an accuracy of 0,1 g, and calculated using Formula (1)

$$u_{23,50} = \frac{m_{23,50} - m_{23,dry}}{m_{23,dry}} \quad (1)$$

5.3 Testing

5.3.1 General

Table 6 gives the dimensions of the test specimens, the minimum number of measurements required to get one test result and any other specific conditions which are necessary.

Table 6 — Test methods, test specimens and conditions

Clause	Title	Test method	Test specimen		Specific conditions
			Dimensions	No. to get one result	
4.2.1	Thermal resistance and thermal conductivity	EN 12667 or EN 12939	See EN 12667 or EN 12939	1	Measuring area: In order to maintain uniform material of the samples the measuring area should be sufficiently large.
4.2.2	Settlement				
4.2.2.2	a) Lofts and floors	B.1	600 mm x 600 mm x 300 mm	1	
4.2.2.3	b) Frame constructions and cavity walls	B.2	2300 mm x 600 mm x 240 mm minimum and 2300 mm x 600 mm x 100 mm minimum	1	
4.2.3	Reaction to fire	See EN 13501-1 and Annex C			
4.3.2	Short-term water absorption	EN 1609, Method A	200 mm x 200 mm x 150 mm or diameter 200 mm x 150mm	4	
4.3.3	Water vapour diffusion resistance factor	EN 12086	See 6.1 of EN 12086:2013	5	
4.3.4	Release of dangerous substances	-	-		[a]
4.3.5	Corrosion resistance	Annex E	20 g test specimens	4	
4.3.6	Mould fungi resistance	Annex F	Petri Dish 90 mm	4	
4.3.7	Airflow resistivity	EN 29053, Method A	See EN 29053 Thickness 100 mm	9	
4.3.8	Continuous glowing combustion	–	–	–	[a]
4.3.9	Sound absorption	EN ISO 354:2003, A.1	Minimum 10m^2	1	
4.3.10	Reaction to fire of products in standardized assemblies simulating end-use applications	Annex J	-	1	-

[a] Test not yet available.

5.3.2 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be determined in accordance with EN 12667 or EN 12939 for thick products and under the following conditions:

— at mean temperature of (10 ± 0,3) °C;

— after conditioning according to step 1 of 5.2 (i.e. under dry conditions);

— using the test specimens prepared by the procedure given in Annex H.

Thermal resistance and thermal conductivity may also be measured at mean temperatures other than 10 °C, providing that the accuracy of the relationship between temperature and thermal properties is well documented.

Thermal resistance and thermal conductivity shall be determined directly at measured thickness. In the event that this is not possible, they shall be determined by measurements on other thicknesses of the product providing that:

— product is of similar chemical and physical characteristics and is produced on the same production line;

— it can be demonstrated in accordance with EN 12939 that the thermal conductivity, λ, does not vary more than 2 % over the range of thicknesses where the calculation is applied.

NOTE The procedures for converting the values of thermal conductivity from one set of temperature and humidity conditions to another are contained in EN ISO 10456 which also contains tabulated values for some products.

6 Designation code

The manufacturer shall give a designation code for a LFCI product. The following shall be included except when there is no requirement for a property as described in 4.3:

— Loose-fill cellulose Insulation (LFCI),

— This European Standard number,

— Settlement class for horizontal applications SHi,

— Settlement class for cavity insulation SCi,

— Water absorption class WSi,

— Corrosion resistance class CRi,

— Class for resistance to biological agents BAi,

— Airflow resistivity AFri,

— Euroclass for reaction to Fire,

— Sound absorption,

— Thermal conductivity (declared density range),

where “i” shall be used to indicate the relevant class or level.

The designation code for a loose-fill cellulose insulation product declared for use as cavity insulation is illustrated by the following example:

EXAMPLE LFCI EN 15101—SC0 – WS2 – CR1 – BA1 – AFr5 – …Reaction to fire……

7 Evaluation of conformity

7.1 General

The manufacturer or his authorised representative established shall be responsible for the conformity of his product with the requirements of this European Standard. The evaluation of conformity shall be carried out in accordance with EN 13172 and shall be based on initial type testing (ITT), factory production control (FPC) by the manufacturer, including product assessment and tests on samples taken at the factory. The compliance of the product with the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

— Initial Type Testing (ITT),

— Factory Production Control by the manufacturer, including product assessment.

If a manufacturer decides to group his products, it shall be done in accordance with EN 13172. The manufacturer or his authorised representative shall make available, in response to a request, a certificate or declaration of conformity as appropriate.

NOTE For the EC certificate and declaration of conformity, as appropriate, see ZA.2.2.

7.2 Initial type testing

ITT shall be carried out in accordance with EN 13172 for all characteristics declared.

7.3 Factory production control

FPC testing shall be made for the characteristics listed in Annex I, when declared. The minimum frequencies of tests in the factory production control shall be in accordance with Annex I of this European Standard. When indirect testing is used, the correlation to direct testing shall be established in accordance with EN 13172.

8 Marking and labelling

Products conforming to this standard shall be clearly marked on the container and/or consignment note with the following information:

— designation code as given in Clause 6;

— product name or other identifying characteristic;

— name or identifying mark and address of the producer or authorised representative established in the EEA;

— date of production (the last two digits);

— shift or time or traceability code;

— reaction to fire class;

— quantity of material in the package (kg);

— an appropriate performance chart based on the example given in Annex K.

NOTE For CE marking, see Annex ZA.

Annex A
(normative)

Determination of declared thermal resistance and thermal conductivity

A.1 General

It is the responsibility of the manufacturer to determine the declared values of thermal resistance and thermal conductivity. The manufacturer shall demonstrate conformity of the product to its declared value. The declared value of thermal resistance and thermal conductivity of a product are the expected value of the property during an economically reasonable working life under normal conditions, assessed through measured data at reference conditions. Thermal conductivity can be measured under dry conditions. The declared values are to be given for a moisture content equal to the one the material has when equilibrium with the air at 23 °C and relative humidity of 50 %. The effects of moisture shall be calculated in accordance with EN ISO 10456. The moisture factors can either used as tabulated values from EN ISO 10456 or can be individually determined as described in Annex D of EN 13171:2012.

A.2 Input data

The manufacturer shall have at least 10 test results for thermal resistance and thermal conductivity, obtained from external direct or from internal direct measurements in order to calculate the declared value. The thermal resistance and thermal conductivity measurements shall be carried out at regular intervals spread over a period of the last 12 months. If less than 10 direct test results are available, that period may be extended until 10 test results are obtained, but with a maximum period of 3 years, within which the product and production conditions have not changed significantly.

For new products, the 10 thermal resistance and thermal conductivity test results shall be carried out spread over a minimum period of 10 days.

The declared value shall be calculated according to the method given in A.3 and shall be recalculated at intervals not exceeding 3 months of production.

A.3 Declared values of thermal resistance and thermal conductivity

The derivation of the declared values R_D and λ_D from the calculated values $R_{90/90}$ and $\lambda_{90/90}$ shall be in accordance with 4.2.1, including the rounding conditions.

The declared value λ_D shall be derived from the calculated value, $\lambda_{90/90}$, which is determined using Formulae (A.1), (A.2) and (A.3), where d_D is the declared thickness and the declared value R_D according to Formulae (A.3):

$$\lambda_{90/90} = \lambda_{mean} + k \times s_\lambda \quad \text{(A.1)}$$

$$s_\lambda = \sqrt{\frac{\sum_{i=1}^{n} (\lambda - \lambda_{mean})^2}{n-1}} \quad \text{(A.2)}$$

$$R_{90/90} = \frac{d_D}{\lambda_{90/90}} \quad \text{(A.3)}$$

k is a factor related to the number of test results available. Values of k are given in Table A1.

Table A.1 — Values for k for one-sided 90 % tolerance interval with a confidence level of 90 %

Number of test results	k
10	2,07
11	2,01
12	1,97
13	1,93
14	1,90
15	1,87
16	1,84
17	1,82
18	1,80
19	1,78
20	1,77
22	1,74
24	1,71
25	1,70
30	1,66
35	1,62
40	1,60
45	1,58
50	1,56
100	1,47
300	1,39
500	1,36
2 000	1,32
For other numbers of test results use ISO 12491 or linear interpolation.	

Annex B
(normative)

Laboratory methods for the determination of settlement

B.1 Blown LFCI for ventilated attics (open blow) — determination of settlement under cyclic humidity

B.1.1 Principle

A test specimen is made by blowing the product into a box. The box with the blown specimen is subjected to temperature and moisture cycling. At the beginning and during the climate cycling the change in thickness is monitored.

B.1.2 Apparatus

B.1.2.1 Open top box, with inside dimensions (length, width, height) of (600 ± 10) mm, (600 ± 10) mm, (300 ± 20 − 0) mm.

The thickness measurements shall be made to the nearest 1 mm at nine positions evenly distributed over the area of the box.

NOTE As an example, nine rulers 320 mm long with maximum diameter 8 mm and graduated in millimetres are fixed at the base and are parallel with the sides of the box and evenly spaced across the base.

B.1.2.2 Climatic chamber, large enough to accommodate the specimen box and providing a controlled climate in the range from 5 °C to 60 °C and relative humidity from 50 % relative humidity to 90 % relative humidity.

B.1.3 Test specimens

B.1.3.1 Preparation of test specimens

Fill the specimen box with a blowing machine (not by hand) with the insulation material to a thickness of 300 mm according to the manufacturer's recommendations for installation.

B.1.3.2 Number of test specimens

The number of test specimens shall be as specified in Table 6. If a number is not specified, use at least one specimen.

B.1.3.3 Conditioning of test specimens

Condition the test specimens for at least 6 h at (23 ± 2) °C. In case of dispute, it shall be carried out at (23 ± 2) °C and (50 ± 5) % relative humidity.

B.1.4 Test procedure

Measure the density of test specimen just after the application: if the density of the test specimen is not within the density range as declared by the manufacturer, make a new specimen meeting the requirements.

To avoid settlement by shock during the installation, carefully install the test box with insulation in the climate chamber. Then start the test in the chamber meeting the following requirements:

Four cycles of one month each are to be conducted (giving a total testing period of four months).

The first cycle of variation of temperature and humidity is conducted according to the following process (for a total period of one month):

Period 1 (high humidity): 14 days (23 ± 5) °C with (90 ± 5) % relative humidity

Period 2 (dry condition): 14 days (50 ± 5) °C with (15+/-5) % relative humidity

Measure the height of specimen: s_1 (mm)

End of first cycle.

The test specimen shall then be subjected to a further three cycles according to the conditions set out in Period 1 and Period 2.

All measured heights are given on a graph according to time.

NOTE The periods can be shortened when experience has been gained with a product.

For each specimen, the mean value of the readings from the nine positions is one test result. This shall be used to create a graph of settlement over time, based upon a best fit formula of an order sufficient to provide a correlation coefficient $R \geq 0{,}95$. The settlement expression S_i for each cycle i ($1 \leq i \leq 4$) is given as follows:

$$s = \frac{s_0 - s_i}{s_0} \times 100 \text{, in \%} \qquad \text{(B.1)}$$

where

s_i is the mean value of measured insulation height in mm for settlement process number i;

s_0 is the mean value of measured insulation height in mm before the settlement process.

The final settlement S corresponds with cycle number 4.

To determine two densities: before and after all settlement cycles:

$$\rho_o = \frac{m_o}{A.s_o} \text{, in kg/m}^3 \qquad \text{(B.2)}$$

$$\rho_s = \frac{m_a}{A.s_a} \text{, in kg/m}^3 \qquad \text{(B.3)}$$

where

m_o is the mean value of measured mass, in kilogram, of the thermal insulation material before settlement process;

m_a is the mean value of measured mass, in kilogram, of the thermal insulation material after settlement process;

A is the base internal area, in square metre, of the test box.

B.1.5 Test report

The test report shall include the following information:

a) reference to this standard;

b) product identification:

   1) product name;

   2) factory, manufacturer or supplier;

   3) production code number;

   4) type of product;

   5) packaging;

   6) the form in which the product arrived at the laboratory;

   7) other information as appropriate, e.g. nominal density;

c) test procedure:

   1) pre-test history and sampling, e.g. who sampled and where;

   2) conditioning;

   3) deviation, if any, from Clauses 6 and 7;

   4) start and end date of testing;

   5) general information relating to the test;

   6) events which may have affected the results;

d) results: mean value and graph of settlement as a function of time.

Information about the apparatus and identity of the technician should be available in the laboratory but it need not be recorded in the report.

B.2 Blown LFCI in timber and steel framed walls – determination of settlement under vibrations[1)]

B.2.1 Principle

A test specimen is made by blowing the product into a specimen box which is similar to a framed wall. This box is subjected to vibrations (for example by a vibration motor). At the beginning and during the test the insulation height in the cavity is measured. The density is then calculated. The test is repeated until there is no further change of settlement. The calculated density is the minimum value to be used for practical application. The procedure may be an iterative process.

B.2.2 Apparatus

A general arrangement of the apparatus is indicated in Figure B.1 and comprises:

1) This method has been used by approved bodies in Germany and Austria since 1985.

B.2.2.1 Specimen box, with a stable base frame of 40 mm thick wood construction with a height of at least 2 300 mm. The cavity depth shall be a minimum of a 100 mm and a maximum used in practice, but at least 240 mm.

The surfaces of the specimen box shall consist of 16 mm plywood sheets. One surface shall be fixed to the frame; the other can be opened to remove the insulation material after the test. It is helpful to install an additional small window located on the top of the central surface (e.g. 4 mm security glass) of 100 mm × 500 mm to be able to see any settling during the test.

The specimen box shall have a turntable built into a framework rack, which stands on 100 mm sound insulation board to absorb the vibration against the ground.

B.2.2.2 Vibration motor; directly installed under the specimen box.

The vibration motor is an electrical motor with an eccentric tappet. The rotation speed shall be about 2 800 1/min. The resulting vibration frequency is between 45 1/s to 50 1/s.

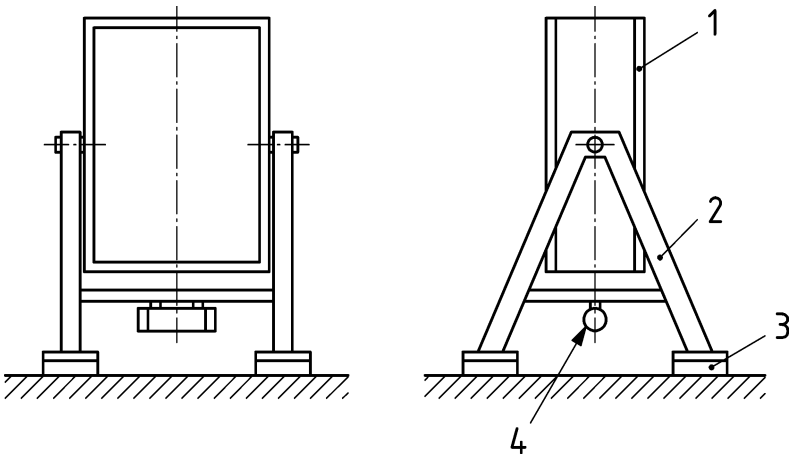
The eccentric tappet shall be adjusted, so that the peak to peak vibration acceleration is approximately 15 m/s^2 and the peak to peak vibration velocity is 35 mm/s.

NOTE These values cover the maximum frequency and acceleration values of the German standard DIN 4150-3 for buildings.

B.2.2.3 Insulation filling machine; used for filling the specimen box, which shall be approved by the manufacturer of the insulation material.

The installation of the material into the specimen box shall be achieved according to the Technical Specification by the manufacturer.

B.2.2.4 Device for measuring the settled height, consisting of a square pressure plate and a tape measure. The tape measure shall have an accuracy of at least 1 mm. The pressure plate of (100 ± 2) mm square and (50 ± 1,5) g shall have an equivalent load of (50 ± 1,5) Pa.



Key

1 specimen box, turntable
2 framework racket
3 100 mm sound insulation material
4 vibration motor

Figure B.1 — Example of apparatus for mechanical settlement of specimen box

B.2.3 Test specimen

B.2.3.1 Dimensions of test specimen (cavity of the specimen box panel)

Height: The cavity shall be at least 2 300 mm.

Width: The width of the cavity shall be at least 600 mm and maximum 800 mm.

Depth: Two different depths shall be measured. One depth shall be (100 ± 10) mm.

One thickness shall be the maximum, in practice the installed thickness.

B.2.3.2 Number of test specimens

The number of test specimen shall be as specified in the relevant product standard. If a number is not specified, at least one specimen for each size and each storage climate shall be used.

B.2.3.3 Conditioning of test specimens

The test specimens shall be conditioned for at least 6 h at (23 ± 5) °C. In case of dispute they shall be conditioned at (23 ± 5) °C and (50 ± 5) % relative humidity for the time specified in the relevant product standard or at least 24 h.

Other additional climates are also possible. Hygroscopic test specimens shall additionally be conditioned at (23 ± 5) °C and (80 ± 5) % relative humidity for the time specified in the relevant product standard or at least 24 h.

B.2.4 Procedure

B.2.4.1 Test conditions

Carry out the test at (23 ± 5) °C.

B.2.4.2 Test procedure

Rotate the specimen box into the vertical position. Check the vibration levels with the empty specimen box before installing the test material.

Adjust the insulation filling machine so that the requested density can be installed. Fill in the test material into the specimen box, using the adjusted insulation filling machine under consideration the manufacturer's technical application for installing.

Start the vibration and apply the vibration for at least 0,5 h.

Measure the settled depth from the top of the specimen box ,s_2, to the nearest 1 mm.

Rotate the specimen box into the horizontal position. Examine the installed insulation visually and note any irregularities like holes or cracks in the distribution. In case of dispute, document evidence with a photograph.

Take the installed material and weigh it. Calculate the density.

If there is settlement, change the density and repeat the test until there is no settlement.

B.2.5 Calculation and expression of test results

B.2.5.1 Settlement

Calculate the settlement, s_d, expressed in percent, using Formula (B.4):

$$s_d = \frac{s_2}{H} \times 100 \text{, in \%} \quad \text{(B.4)}$$

where

s_2 is the measured settled depth of the thermal insulation, in millimetres;

H is the height of the cavity, in millimetres.

Calculate the test result of the settlement, s_d, in percent rounded to the nearest 0,5 %.

B.2.5.2 Density

Calculate the density of the installed insulation, ρ, expressed in kg/m³, using Formula (B.5):

$$\rho = \frac{m}{H \times W \times D} \quad \text{(B.5)}$$

where

m is the weight of the thermal insulation, in kilograms;

H is the height of the cavity, in metres;

W is the width of the cavity, in metres;

D is the depth of the cavity, in metres.

Calculate the test result of the density, ρ, expressed in kg/m^3 rounded to the nearest kg/ m^3.

NOTE The density with non-settling is the minimum usable density for the tested thermal insulation material, installed in vertical walls. The density can be different for different insulation thicknesses (cavity depths).

B.2.6 Accuracy of measurements

NOTE It has not been possible to include a statement of the accuracy of the method in this edition of the standard, but it is intended to include such a statement when the method is next revised.

B.2.7 Test report

The test report shall include the following information:

a) reference to this standard;

b) product identification:

1) product name;

2) factory, manufacturer or supplier;

3) production code number;

4) type of product;

5) packaging;

6) the form in which the product arrived at the laboratory;

7) other information as appropriate, e.g. nominal density;

c) test procedure:

1) pre-test history and sampling, e.g. who sampled and where;

2) conditioning;

3) if any deviation from any clauses;

4) date of testing;

5) general information relating to the test;

6) events which may have affected the results;

d) results: all individual values and the mean value.

Information about the apparatus and identity of the technician should be available in the laboratory but it need not be recorded in the report.

B.3 Blown LFCI for ventilated attics — determination of settlement under impact excitation and under increased temperature and moisture (informative and for FPC only)

B.3.1 Principle

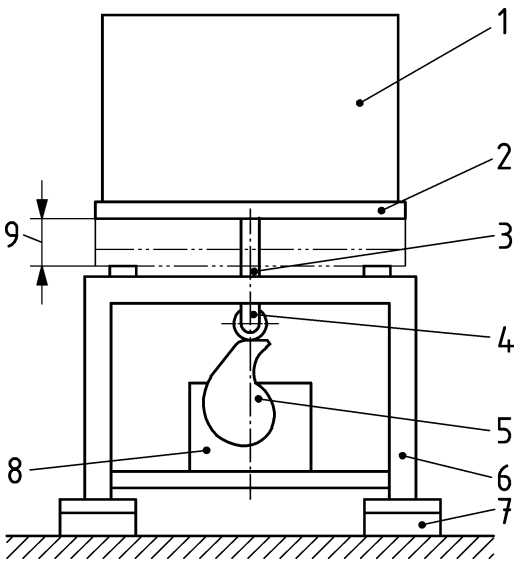
A test specimen is made by blowing the product into a box. The box with the blown specimen is first subjected to impact excitation and then to increased temperature and moisture. At the beginning, after impact excitation and during the climate storage, the thickness is measured. The overall settlement height and density is calculated.

B.3.2 Apparatus

B.3.2.1 Specimen box, with inside dimensions of length (550 ± 5) mm, width (550 ± 5) mm and height (330 ± 5) mm.

B.3.2.2 Stable steel for impact excitation, on which a motor with a cam disc is assembled.

A moveable frame is led by centre bearings so that it drops free of friction from the top point to the impact bed. The cam disc lifts the movable frame by a ram stake to the top point. Behind the top point, the movable frame drops down to the impact beds. The drop height can be adjusted to a height of (50 ± 5) mm. The number of drops shall be 20 times. In order to keep the means, the motor should be controlled by a counter. The specimen box is mounted on the movable frame (see Figure B.2).



Key

1	test box	6	ground frame
2	movable steel frame	7	shock absorber
3	ram stake	8	counter controlled motor
4	ball bearing	9	drop height
5	cam disk		

Figure B.2 — Apparatus for impact excitation

B.3.2.3 Climatic chamber, large enough to accommodate the specimen box and provide a controlled climate of (40 ± 5) °C, (90 ± 5) % relative humidity.

B.3.2.4 Insulation filling machine, used for filling the specimen box, which shall be approved by the manufacturer of the insulation material.

The installation of the material into the specimen box shall be achieved according to the technical application of the manufacturer.

B.3.2.5 Device for measuring the height, consisting of a square pressure plate and a tape measure. The tape measure shall have an accuracy of at least 1 mm. The pressure plate of (200 ± 2) mm square and (80 ± 6) g shall have an equivalent load of (20 ± 1,5) Pa.

B.3.3 Test specimens

B.3.3.1 Preparation of test specimens

The test specimens shall be prepared as under working conditions. Fill the material to be tested into the boxes manually or mechanically by special equipment. The surface of test specimen shall correspond with the surface of the test boxes.

When manually preparing the test specimen, material shall be carefully filled into the test box by using a shovel. The quantity of the test material is selected in the way that the specimen is able to achieve the required density.

When using mechanical equipment, the test boxes shall be filled using a tube of a diameter similar to that used in working conditions. If it is normal under working conditions to use a blowing nozzle, the test specimen shall also be prepared by means of a nozzle. The mechanical equipment shall be adjusted in such a way that the required density can be achieved in the specimen box.

B.3.3.2 Number of test specimens

The number of test specimens shall be at least one specimen.

B.3.3.3 Conditioning of test specimens

Before preparing the specimens, the test material shall be stored for at least 6 h at (23 ± 2) °C. In case of dispute, conditioning shall be carried out at (23 ± 2) °C and (50 ± 5) % relative humidity.

B.3.4 Test procedure

Check the drop height with the empty specimen box before installing the test material. Adjust the insulation filling machine so that the requested density can be installed. Fill in the test material into the specimen box, using the adjusted insulation filling machine in accordance with the manufacturer's technical application for installing.

At the centre of the specimen box, measure the initial thickness of the insulation, s_1, to the nearest 1 mm.

Start the machine for the impact excitation for access 20 drops.

Then at the same the initial thickness, measure the settled thickness of the insulation, s_2, to the nearest 1 mm.

Replace the test specimen box from the framework rack. To avoid settlement during transportation, carefully transport the specimen box with insulation and install it in the climate chamber.

Control the climate chamber at the following conditions: (40 ± 5) °C, (90 ± 5) % relative humidity.

At the same position where the initial thickness was measured, measure the settled thickness of the insulation after week 1, s_{c1}, to the nearest 1 mm.

Repeat the procedure in the climate chamber until the thickness changing during one week is less than 1 %. The last measured thickness, s_{cn}, after week one s_{c1}, after week two s_{c2} is the climate settled thickness, s_c. To avoid settlement by handling, carefully install the test box with insulation in the climate chamber.

NOTE The periods can be shortened when experience has been gained with a product.

B.3.5 Calculations and expression of results

B.3.5.1 Settlement after vibration test

Calculate the settlement ,s_v, expressed in percent, using Formula (B.3):

$$s_v = \frac{s_i - s_1}{s_i} \times 100 \text{ , in \%} \qquad \text{(B.6)}$$

where

s_i is the measured initial thickness at the beginning, in millimetres;

s_1 is the measured thickness after the vibration test, in millimetres.

Calculate the test result of the settlement, s_v, in percent rounded to the nearest 0,5 %.

B.3.5.2 Settlement after increased temperature and humidity (for information only)

Calculate the settlement, s_{cli} , expressed in percent, using the Formula (B.4):

$$s_{cli} = \frac{s_0 - s_{ac}}{s_0} \times 100 \text{, in \%} \quad \text{(B.7)}$$

where

s_0 is the measured thickness before climate test, in millimetres;

s_{ac} is the measured settled thickness after increased temperature test, in millimetres.

Calculate the test result of the settlement, s_{cli}, in percent rounded to the nearest 0,5 %.

B.3.5.3 Mean declared settlement value

Calculate the mean declared settlement value, s_d, expressed in percent, using the Formula (B.5):

$$s_D = \frac{s_i - s_{ac}}{s_i} \times 100 \quad \text{(B.8)}$$

where

s_i is the measured initial thickness at the beginning, in millimetres;

s_{ac} is the measured settled thickness after the vibration and climate test, in millimetres

Calculate the test result of the settlement, s_D, in percent rounded to the nearest 0,5 %.

B.3.5.4 Density

Calculate the density of the installed insulation, ρ, expressed in kg/m^3, using Formula (B.9):

$$\rho = \frac{m}{L \times W \times D} \quad \text{(B.9)}$$

where

m is mass;

D is the thickness of the specimen box, in metres;

W is the width of the specimen box, in metres;

L is the length of the specimen box, in metres.

Calculate the test result of the density, ρ, expressed in kg/m^3 rounded to the nearest 1 kg/m^3.

B.3.6 Test report

The test report shall include the following information:

a) reference to this standard;

b) product identification:

1) product name;

2) factory, manufacturer or supplier;

3) production code number;

4) type of product;

5) packaging;

6) the form in which the product arrived at the laboratory;

7) other information as appropriate, e.g. nominal density.

c) test procedure:

1) pre-test history and sampling, e.g. who sampled and where;

2) conditioning;

3) if any deviation from Clauses 6 and 7;

4) start and end date of testing;

5) general information relating to the test;

6) events which may have affected the results.

d) results: mean value and graph of settlement as a function of time.

Information about the apparatus and identity of the technician should be available in the laboratory but it need not be recorded in the report.

Annex C
(normative)

Testing for reaction to fire of products

C.1 Scope

C.1.1 General

This annex gives basic rules for reaction to fire testing of products as placed on the market (product itself) including instructions for mounting and fixing, taking into account the product tested in isolation and not related to any end-use application and instructions for the field of application of the test results.

The following is related to 4.2.3 in the main body of the product standard.

C.1.2 Product and installation parameters

The test specimens shall be conditioned for at least 6 h at (23 ± 5) °C. In case of dispute, they shall be conditioned at (23 ± 2) °C and (50 ± 5) % RH for 14 days.

Tables C.1 and C.2 give the parameters that shall be taken into account when determining a product's reaction to fire performance and the field of application of the test results.

Table C.1 — Product parameters

Product parameter	EN 13823 (Euroclass A1 to D)	EN ISO 11925-2 (Euroclass B to E)
Thickness	X	X
Density	X	X

NOTE Ageing procedures are not applicable for the test specimens.

Table C.2 — Installation parameters

Installation parameter	EN 13823	EN ISO 11925-2
Exposure to thermal attack	X	X
Substrate	X	—
Air gaps/cavities	X	—
Joints/edges	—	—
Size and positioning of test specimen	X	—
Product orientation and geometry	—	—
Fixing of the test specimen	X	—

C.1.3 Ignitability (EN ISO 11925-2)

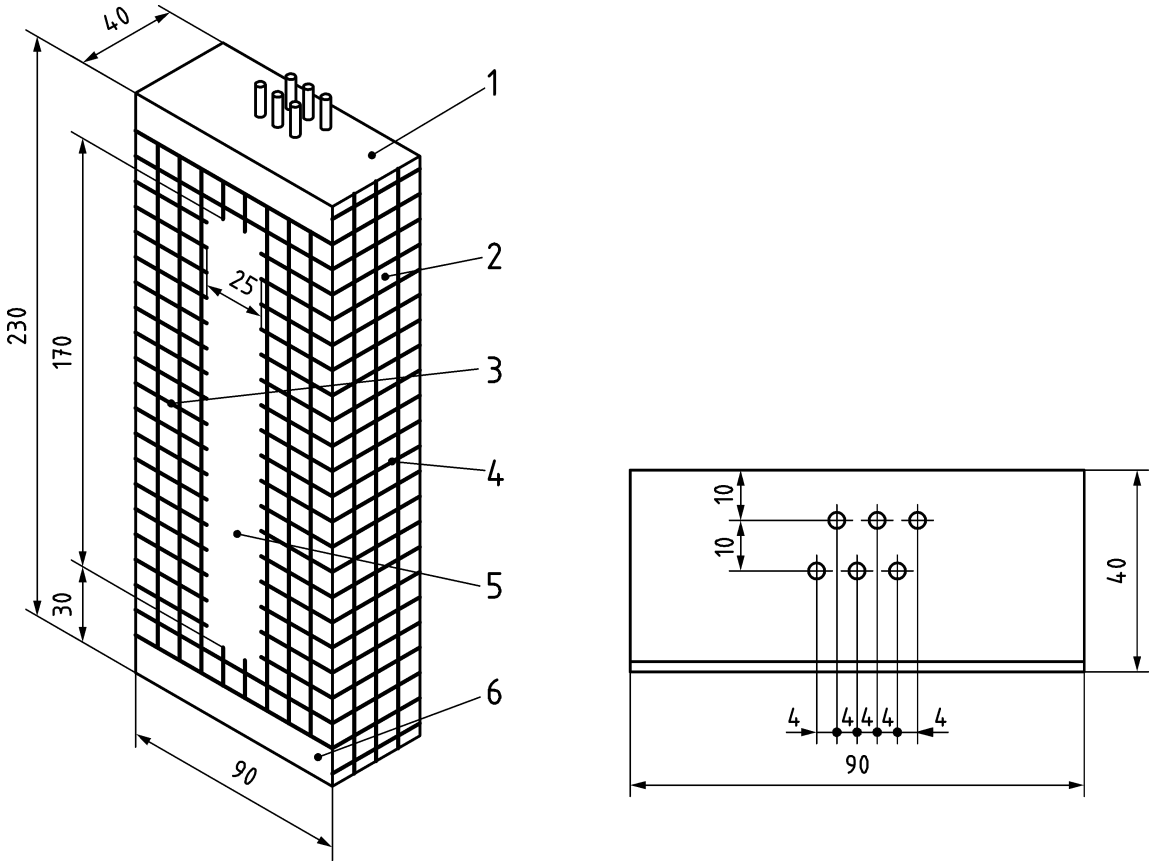
C.1.3.1 Exposure to thermal attack

The product shall be tested directly exposed to the thermal attack.

The test specimen is submitted to direct flame exposure in a specimen holder cage. The dimensions of the specimen in the cage are 180 mm long, 90 mm wide and 40 mm deep. The dimensions of the specimen holder cage (including the hardwood top and bottom) are 230 mm long, 90 mm wide and 40 mm deep. The mass of the test specimen added by hand into the cage is determined by the density range of application.

NOTE The panels are made of wire mesh and are not made of a solid panel substrate.

Dimensions in millimetres



Key

1 small hardwood blocks, 90 mm x 40 mm x 25 mm (beech or oak)
2 back panel (not shown) door as filling hole
3 side panel (not shown)
4 wire mesh, zinc-coated width of mesh 9,6 mm wire size 0,9 mm
5 flame attack opening 170 mm x 25 mm resistance wire is used as bracing wire, diameter 0,2 mm; 15,6 ohm/m
6 screwed on sheet metal, 16 mm x 1,4 mm with 11 guides notches at top and bottom, spaced at intervals of 2 mm

Figure C.1 — Test specimen holder apparatus for Ignitability EN ISO 11925-2

C.1.3.2 Substrate

The test specimens shall be mounted in the test apparatus without a substrate.

C.1.4 Single Burning Item [SBI] (EN 13823) for loose-fill cellulose insulation products

C.1.4.1 Preparation of the test specimens

A test specimen shall be prepared by blowing, spraying or hand placing onto the internal face of an L-shaped substrate which is prepared according to EN 13823.

C.1.4.2 Exposure to thermal attack

The product shall be tested directly exposed to the thermal attack.

C.1.4.3 Substrate

The type of the substrate is defined in EN 13238. The general substrate to be used to test the product as placed on the market is made of wood fibre board (≥ 220 kg/m^3). Calcium silicate, Gypsum plaster board, full timber and wood particle board substrates such as defined in EN 13238 are permitted to be used instead. For A1 classification, a calcium silicate substrate is compulsory.

The test conditions and field of application of the classification shall be given in the declaration of conformity, in the classification report and is requested to be included in the manufacturer's technical literature.

C.1.4.4 Air gaps/cavities

Air gaps/cavities are considered not to be relevant for the reaction to fire behaviour of the product.

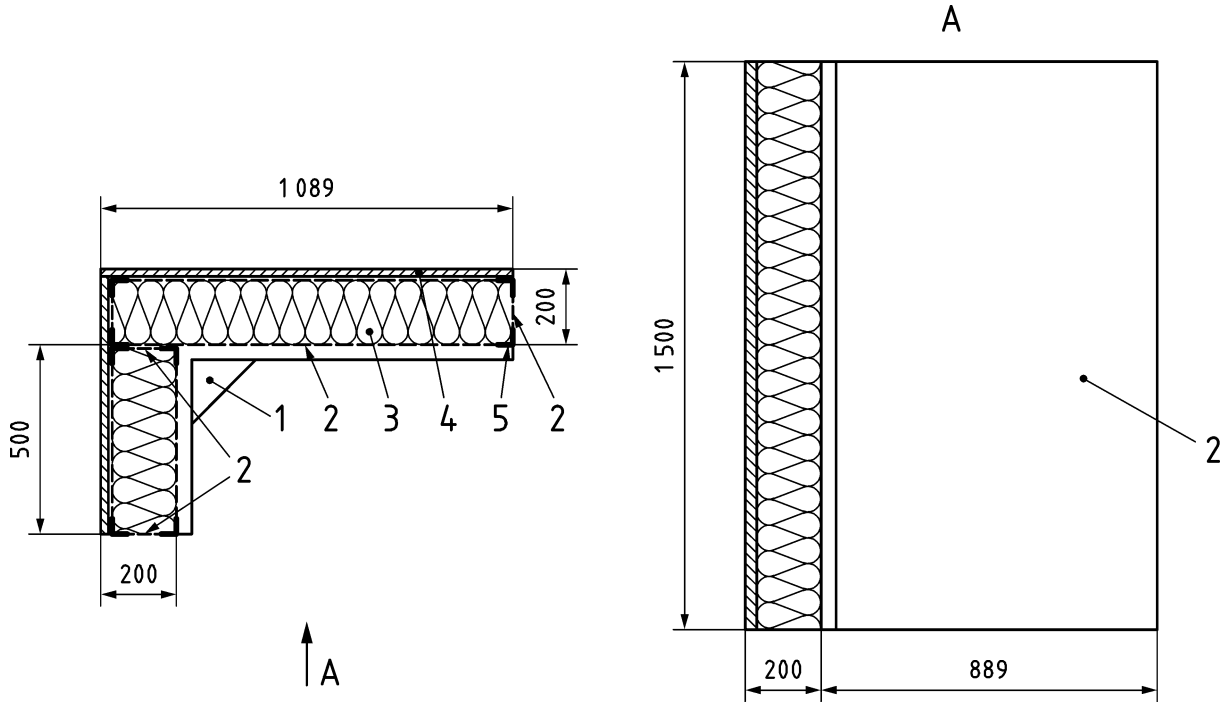
C.1.4.5 Size and positioning of test specimen

The size of the test specimens is given in EN 13823:2010, 5.1. Positioning of the test specimens shall meet the following specification:

The maximum thickness of the test specimen including the substrate that can be installed in the SBI test is 200 mm.

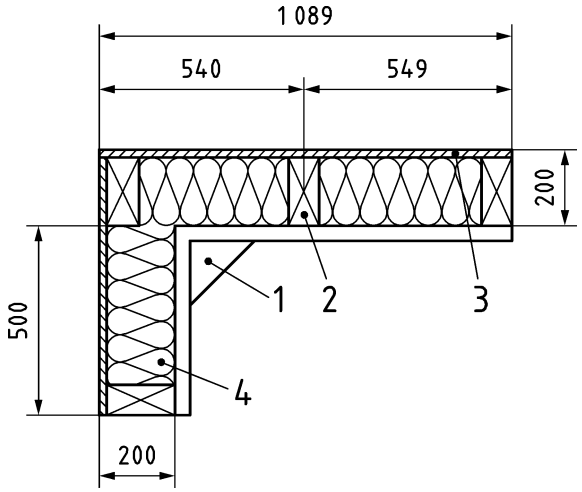
The test specimen shall be positioned as shown in Figures C.2a and Figure C.2b.

Dimensions in millimetres



Key
1 SBI –burner
2 wire mesh
3 thermal insulation
4 substrate
5 steel-square stud

Figure C.2a — Installation of the test specimen (dry blown - top view)



Key
1 SBI-burner
2 timber or steel stud
3 substrate
4 thermal insulation

Figure C.2b – Installation of the test specimen (spray process - top view)

C.1.4.6 Fixing of the test specimen

The specimen with its substrate shall be fixed in the test apparatus either by blowing the dry loose-fill material (see Figure C.2a), or via the spray process (the cellulose bonds onto the substrate by using a fine spray of moisture, see Figure C.2b). When spraying the loose-fill Cellulose insulation, it is optional for the manufacturer to use a wire mesh for stabilisation of the loose-fill material. In this case, a layer of up to a 100 mm is sprayed onto the substrate and a wire mesh is installed at this point. Then a second layer of loose-fill cellulose insulation shall be sprayed upon the first layer of LFCI (up to 200 mm including the substrate). The specimen is left to dry until it reached the constant mass (at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 10) %).

In the case of conducting the SBI test in the dry blown process, comparative tests by a certified testing institute shall have proven that the wire mesh on the surface - which is being used to hold the loose-fill material in the test specimen - does not influence the final testing result in the SBI test. This is achieved by performing test using both methods.

The wire mesh set-up shall consist of two wire mesh types, e.g. a) a fine wire mesh with the diameter of 1 mm and a rectangular format of 3/3 mm and b) of a cruder wire mesh with a diameter of 4 mm and a rectangular format of 50/50 mm.

C.1.4.7 Field of application

The manufacturer is responsible for the grouping of his products following the rules described in EN 13172 and this European Standard. The validity of the test results and the field of application for a product group is determined by the product parameters and the installation parameters with the requirements given in Tables C.3 and C.4.

Table C.3 — Product parameters

Product parameter	Validity of test results			
	EN ISO 1182 Not relevant	**EN ISO 1716** Not relevant	**EN 13823 (SBI)**	**EN ISO 11925-2 (Ignitability)**
Thickness			Test results are valid for equal or lower thickness	
			Test results on a 180 mm thickness are also valid for higher thickness	Test results on 40 mm thickness are also valid for higher thickness
Density			Product density range	

Table C.4 — Installation parameters

Installation parameter	Validity of test results	
	EN 13823 (SBI)	**EN ISO 11925-2 (Ignitability)**
Exposure to thermal attack	Test result is valid for product as placed on the market	See C.3.2.2
Substrate	The wood fibre board (≥ 220 kg/m^3) represents all substrates, Euroclass E or better. The standard particle board substrates (≥ 680 kg/m3 ± 50 kg/m^3) represent all wood substrates Euroclass D2. The standard gypsum plaster board represents A2 substrates. The standard calcium silicate (non paper faced) board represents all A1 and A2 substrates.	Not relevant
Air gaps / cavities	Test result valid for product applied with or without an air gap	Not relevant
Size and positioning of test specimen	Test result is valid for all product sizes	Not relevant
Fixing of test specimen	Test result is valid for all product fixings	Not relevant

Annex D
(normative)

Specimen preparation method for the water absorption test

D.1 Principle

The insulation is blown into a test cage. The blown insulation is then used to create a test specimen with coverage and density in accordance with the minimum density of the declared density range.

D.2 Conditioning

Each test specimen shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 24 h prior to testing.

D.3 Procedure

Blow the insulation product into a test cage made from stainless steel mesh with an open area of at least 50 %. Ensure the cage has dimensions of (200 ± 1) mm × (200 ± 1) mm or a diameter of (200 ± 1) mm with a removable face for installing the insulation product. The height of the test cage should have a minimum of (150 ± 1) mm.

Weigh the empty frame before the blowing is carried out. Record the weight, w_1.

Calculate the weight of the insulation, w_2, needed to get a specimen corresponding to the minimum density of the declared density range.

Carry out the sample preparation by blowing with a commercial blowing machine. Load the machine with enough insulation material to give an even flow during the whole specimen preparation process.

After blowing, weigh the filled frame again. In order to get a specimen in accordance with the performance chart, remove insulation until the desired total weight, w_1+w_2, is reached.

Replace the movable lid, compressing the insulation to the internal dimensions of the cage.

Annex E
(normative)

Method of test for corrosion resistance

E.1 Principle

This test is intended to provide a basis for the acceptance or rejection of the level of corrosiveness displayed by a fibrous insulation where water may cause chemical constituents to migrate to thin copper- or zinc-coated elements adjacent to the insulation.

NOTE 1 This is an accelerated test and analytical laboratory hygiene is required at all stages.

NOTE 2 Material passing this test is deemed acceptable when installed adjacent to the thick-sectioned steel components (e.g. nails) which may be present in a loft. Thin-sectional steel components devoid of zinc coating or other protection are at risk in any humid loft environment irrespective of the nature of any insulation present.

E.2 Conditioning

Each test specimen shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 24 h prior to testing.

E.3 Reagents and materials

E.3.1 Four metal test coupons, two of copper foil of 99,9 % purity and two of zinc foil of 99,9 % purity, each 50 mm × 50 mm × 0,075 mm, judged free of tears, distortions, scratches, perforations, corrosion or other flaws when viewed under and over a 40 W coiled incandescent light bulb.

E.3.2 Trichloroethylene, of analytical reagent quality.

NOTE Attention is drawn to the possible health risks when using this material.

E.3.3 Sulphuric acid, (C) H_2SO_4 = 0,5 mol/l to 1 mol/l.

E.3.4 Saturated ammonium acetate solution.

E.4 Apparatus

E.4.1 Humidity chamber, maintained at (40 ± 2) °C and (90 to 95) % relative humidity.

E.4.2 Four cylindrical glass crystallising dishes, well washed, nominally 90 mm in diameter and 50 mm deep.

E.4.3 Rubber or PVC gloves.

E.4.4 Stainless steel spatula.

E.4.5 Tweezers.

E.5 Procedure

Wash each metal coupon successively in two glass dishes of the trichloroethylene to remove any grease or oil, and dry at room temperature. At this and all subsequent handling of the coupons, ensure thin rubber or PVC gloves are worn and tweezers used.

a) Take four 20 g samples of fibrous insulation and mix each with 150 ml of distilled or deionised water at room temperature in a clean glass beaker.

b) Transfer approximately half of one sample of the saturated fibrous insulation, using gloved hands and a clean stainless spatula, to one of the crystallising dishes and tamp level such that a layer of 10 mm to 15 mm thickness is formed. Place one of the metal coupons horizontally on this layer by introducing one end at a slight angle to the saturated material, progressively pressing the remainder of the coupon gently down and shaking the dish slightly, in such a way that all air bubbles are expelled from the underside of the coupon. If necessary, gently tamp the saturated layer and coupon level again.

   Transfer the remainder of the sample of saturated fibrous insulation as before, together with any free liquor, to cover the first layer and coupon evenly. Carefully remove any air (silvery bubbles) still visible through the glass and then gently tamp the compact level. Repeat the above procedure so that composite test assemblies are produced for all four metal coupons.

c) Transfer the four composite test assemblies without delay to the preconditioned humidity chamber.

   The assemblies are not covered, but if the chamber is capable of dripping onto them, position a guard so as to prevent it.

d) Leave the test assemblies undisturbed in the humidity chamber for (336 ± 4) h (14 days), except for brief and occasional opening of the chamber for visual inspection or the introduction of other test assemblies. If, as a result of a visual inspection, it is found that a detectable drying of the surface of a composite test assembly has occurred, the minimum quantity of distilled or deionised water necessary to restore the original condition may be sprayed onto that surface, and a check made on the functioning of the chamber.

e) Upon completion of the test period, take the metal coupons from the assemblies and remove loose corrosion products by immersion for not longer than 30 s, as follows:

   1) copper coupons in sulphuric acid at room temperature;

   2) zinc coupons in saturated ammonium acetate solution at room temperature.

   Wash the coupons immediately under running water and dry without delay.

f) Immediately after cleaning, examine the metal coupons for perforation over the 40 W light bulb. Discount any notches or perforations within 3 mm of the edge of a coupon and note only those perforations within the remaining central zone.

E.6 Classification of the results

The result shall be classified as follows:

CR – Test passed: No perforation of the coupons shall be observed as defined in E.2.

E.7 Report

This test report shall include the following information:

a) product details;

b) date of test;

c) if the product has passed (CR) or failed the test.

Annex F
(normative)

Method for determining mould fungi resistance

F.1 Scope

This test method covers the determination of the resistance of LFCI products to mould fungal growth.

F.2 Significance and use

F.2.1 The type of materials used in the manufacture of insulation products can sometimes be affected by fungi attack in the presence of high humidity.

F.2.2 This test method is used to determine the relative ability of an insulation to support or resist fungal growth under conditions favourable for their development.

F.2.3 This test method uses a comparative material to determine the relative ability of a material to support fungal growth. Classes of resistance towards Biological Agents (BA) shall be assessed in accordance with Table F.1 of this annex.

F.3 Apparatus

F.3.1 **Petri dishes**, sterile.

F.3.2 **Environmental chamber or cabinet**, capable of maintaining a temperature of (28 ± 2) °C and a relative humidity of (95 ± 4) %. Provisions shall be made to prevent condensation from dripping on the test specimen. There shall be free circulation of air around the test chamber.

F.3.3 **Atomiser**, ultrasonic atomiser capable of providing (15 000 ± 3 000) spores/cm^2 for inoculation.

F.3.4 **Autoclavable biohazard bags**, or metal pan able to withstand autoclaving.

F.4 Reagents and materials

F.4.1 Water

Distilled water or water of equal purity.

F.4.2 Inoculum

Fungi	Example
Aspergillus niger	ATCC 6275
Trichoderma viride	ATCC 9645
Penicillium funiculosum	ATCC 36839
Chaetomium globosum	ATCC 6205
Paecilomyces variotii	ATCC 18502

The fungi strains shall be obtained from accepted reference stocks.

F.4.3 Cultures, maintained in vitro on Maltextract-Oat-agar (20 g oatmeal, 10 g malt extract and 20 g agar in 1 000 ml water) or in accordance with the commendation of the reference stock.

The stock cultures shall not be kept for more than 6 months at (6 ± 4) °C at which time subcultures shall be made, and new stocks shall be selected from the subcultures. Incubate subcultures used for preparing new stock cultures at (28 ± 2) °C for 5 days or longer but at most 14 days. Use the same procedure to prepare cultures for the spore suspension for inoculation.

F.5 Specimens

F.5.1 Viability control specimens

Determine the viability of the spore suspension during incubation with these controls: with each daily group of tests, place one piece of sterilised white filter paper (2 × 3) cm on each of two prepared hardened Maltextract-Oat-agar Petri dishes.

F.5.2 Comparative material

Specimens of beech wood or pine sapwood (30 × 30 × 5) mm are the comparative items to determine the relative growth on specimen being tested. The choice of comparative item should be noted.

F.5.3 Test specimens

Prepare four replicate test specimens from each test sample.

Use enough material in a sterile Petri dish to be able to gently tamp down to a smooth surface. This will facilitate microscopic examination.

F.6 Procedure

F.6.1 Spore suspension

Prepare a spore suspension of each of the five fungi by pouring into one subculture of each fungus a 10 ml portion of a sterile solution containing a sufficient quantity, not exceeding 0,10 g/l, of a non-toxic wetting agent such as sorbitan monoleate (Tween-80), sodium dioctyl sulfosuccinate, or sodium lauryl sulfate to prevent clumping of the spores. Gently scrape the surface growth from the culture of the test organism using a sterile platinum or nichrome inoculating wire. Pour the spore charge into a sterile 125 ml glass-stoppered Erlenmeyer flask containing (45 ± 1) ml of sterile water, and 50 to 75 solid glass beads, approximately 5 mm in diameter. Vigorously shake the flask to liberate the spores from the fruiting bodies and to break the spore clumps. Filter the dispersed fungal spore suspension through at least a 6 mm layer of glass wool contained in a glass funnel, into a sterile flask. This process is intended to remove large mycelial fragments and clumps of agar that could interfere with the spraying process. Centrifuge the filtered spore suspension. Remove all the

supernatant down to the surface of the spore pellet, taking care not to remove or disturb the spore pellet. Resuspend the residue in 50 ml of sterile water and centrifuge. (It may be necessary to add a small quantity of non-toxic wetting agent, not to exceed 0,10 g/l, to prevent clumping of the spores.) Wash the spores obtained from each of the fungi in this manner three times. Dilute the final washed residue with distilled water in such a way that the resultant spore suspension contains (1 000 000 ± 200 000) spores per ml as determined with a counting chamber. Repeat the operation for each organism used in the test and blend equal volumes of the resultant spore suspensions to obtain the final mixed spore suspension. The spore suspension may be prepared fresh each day or may be held at (6 ± 4) °C for not more than 7 days.

F.6.2 Inoculation of test specimens, comparative material and control specimens

Precondition the chamber with the specimens in Petri dishes at (28 ± 2) °C and (95 ± 4) % relative humidity for at least 4 h. Inoculate the specimens with the mixed fungus spore suspension by spraying it on these items in a fine mist from a previously sterilised atomiser or nebuliser. Take care to spray all surfaces. Take care to ensure that all samples and controls receive the same amount of inoculums (10^5 spores per test specimen). Place the lid on the Petri dish for the remainder of the test. Start incubation immediately following the inoculation.

F.6.3 Incubation

Maintain the test chamber at (28 ± 2) °C and a relative humidity of (95 ± 4) % throughout the test. Keep the test chamber closed during incubation except during inspection. After 3 days to 7 days, inspect the control specimens. If control specimens do not show an abundance of growth at this time, repeat the entire test. If growth is present on the control specimens, continue the test for a minimum period of 28 days ± 8 h from the time of incubation. Refer to the material specifications for incubation periods.

F.7 Test analysis

F.7.1 General

Evaluation: At the end of the incubation period, remove the test specimens and comparative item from the test chamber and examine with naked eye and – if no mould is visible – with reflected-light microscope at 50× magnification. For each test replicate, a BA class, as given in Table F.1, is to be determined.

Table F.1 — Ranking criteria

Class BA	*Intensity of growth in relation to comparative material*
0	no mould visible on specimen surface, examined with reflected-light microscope at 50× magnification
1	mould growth not or hardly visible to the naked eye, but clearly visible at 50× magnification
2	mould clearly visible to the naked eye – considerably weaker than on the comparison material
3	mould clearly visible to the naked eye – equal or more intensive than on the comparison material

F.7.2 Validation

The test is valid if at least 50 % of the surface area of the comparative material is covered with mould, visible to the naked eye.

F.7.3 Classification

The BA class for the test material is to be determined as integral mean value from the four single values of the replicate test specimens from each test sample.

WARNING — After completion of inspection, all test specimens and test equipment shall be autoclaved under the manufacturer's autoclave instructions to ensure destruction of vegetative cells and spores to prevent accidental contamination to the laboratory and environment.

F.8 Report

Report the following information:

— complete identification of the material tested;

— identification of variable test conditions (comparative item, sample moistening, test duration) criterion used to determine Pass/Fail (comparative item or no growth); and

— results of the test (classification according to table F.1 of this annex).

F.9 Precision and bias

No statement is made about either the precision or the bias of this mould fungi resistance test method since the test is a subjective, visual determination of whether the test material differs from a comparative material.

Annex G
(normative)

Specimen preparation method for the airflow resistance test

G.1 Principle

The insulation is blown into a sample holder. The blown density shall be in accordance with the minimum density of the declared density range.

G.2 Procedure

Blow the insulation product into a sample holder with an installed thickness of at least 100 mm.

Carry out the blowing with a commercial-type blowing machine. Ensure the machine is loaded with enough insulation material to give an even flow during the whole specimen preparation process.

After blowing, take the sample holder to the test apparatus. Ensure the specimen has an even distribution of cellulose and a coverage and density in accordance with the minimum density of the declared density range.

Annex H
(normative)

Specimen preparation method for thermal resistance and thermal conductivity test

H.1 Principle

The insulation is blown into a frame. The blown insulation is then used to create a test specimen with coverage and density in accordance with the declared density range and an installed thickness of at least 50 mm. In all cases ensure the frame is made from a rigid insulating material e.g. cellular plastic. Ensure the bottom of the frame is made from a thin material that will only give a negligible contribution to the total thermal resistance, e.g. plastic foil. In order to obtain a frame with a flat bottom, place a rigid sheet under the plastic foil to support it during blowing and transportation.

H.2 Procedure

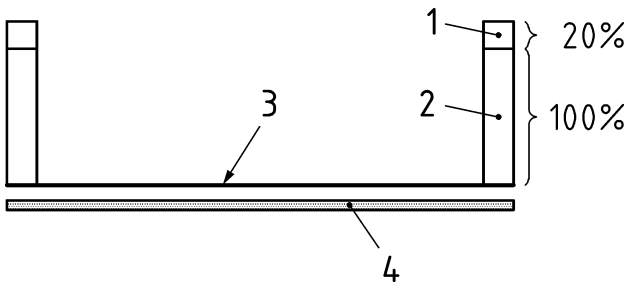
H.2.1 Horizontal applications, loft and floors

Blow the insulation product into a square rigid frame large enough to provide a test specimen corresponding to the dimensions of the metering area of the test equipment (see Figure H.1 for an example). The height of the frame corresponds to the thickness of the test specimen. During the blowing, the product is likely to settle. To take into account this phenomenon and prevent the possible presence of air gaps between the surface of the insulation and the plates of the measuring device, a thickness of 20 %, the same material as the frame, is temporally positioned above the frame, called the raises. The product is then blown into the cavity thus formed.

Carry out the blowing with a commercial-type blowing machine. Ensure the test specimen box is loaded with enough insulation material to give an even flow during the whole specimen preparation process. After blowing, weigh the filled frame and the supporting sheet again. In order to get a specimen in accordance with the performance chart, remove insulation by hand until the desired total weight, $w1 + w2$, is reached.

Ensure the insulation surface is flat and the specimen has an even insulation distribution.

Gently carry the specimens to a ventilated oven, dry to a constant mass at a minimum temperature of 60 °C. The raises shall be removed during the thermal test. The density of the sample is calculated without the raises.



Key

1 raise
2 frame
3 plastic foil
4 rigid sheet

Figure H.1 — Example of test frame for horizontal applications

H.2.2 Cavity insulation, frame constructions and cavity walls

The principle is to blow the insulation product into a frame, which is put in a wooden box like represented in Figure H.2. The rigid frame containing the insulation product is large enough to provide a test specimen corresponding to the dimensions of the metering area of the test equipment.

— Place on a balance the wooden box and sample frame.

— Close the wooden box tighten in order to blow under pressure.

— Carry out the tare.

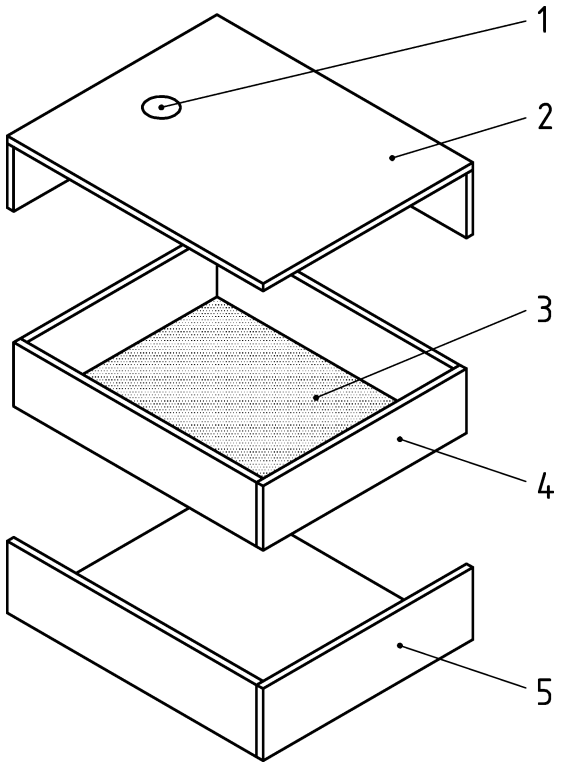
— Perform the settings of the machine.

— Place the head of the blowing apparatus into the opening of the wooden box.

— Start the blowing, then rotate the nozzle to fill the tube evenly.

— When the cavity is filled, stop blowing.

— Weigh and calculate the density of the specimen.



Key

1 blowing hole
2 box upper part
3 plastic foil
4 frame
5 box lower part

Figure H.2 — Example frame and box for closed constructions

Annex I
(normative)

Factory production control

Table I.1 — Minimum product testing frequencies

Clause	Title	ITT Minimum number of tests	FPC Minimum testing frequency		
			Direct testing	Indirect testing	
				Test method	Frequency [a]
4.2.1	Thermal resistance and thermal conductivity	4	1 per day or one every three months for each product group and indirect testing	– Manufacturer´s method	– 1 per day
4.2.2.2	Settlement (open blow) Horizontal applications, loft and floors	2	indirect testing	B.3	4 per year
4.2.2.3	Settlement Cavity insulation, frame constructions and cavity walls	1	indirect testing	Manufacturer´s method	1 per day
4.2.3	Reaction to fire	See Table I.2	See Table I.2		
4.3.2	Short-term water absorption	1	1 per month and indirect testing	Manufacturer´s method	1 per day
4.3.3	Water vapour diffusion factor	1 [d]	--	–	–
4.3.4	Release of dangerous substances	See footnote [b]	2	–	–

Clause	Title	ITT Minimum number of tests	FPC Minimum testing frequency		
			Direct testing	Indirect testing	
				Test method	Frequency [a]
4.3.5	Corrosion resistance	ITT [c]	--	–	–
4.3.6	Mould fungi resistance	ITT [c]	--	–	–
4.3.7	Airflow resistivity	1	1 per year	–	–
4.3.8	Continuous glowing combustion	See footnote [b]	2, See footnote [b]	–	–
4.3.9	Sound absorption	ITT [c]	--	–	–

[a] The minimum testing frequencies shall be understood as the minimum for each production unit/line under stable manufacturing conditions. If for example the production per day is only 8 h, every day is a new start. In addition to the testing frequencies given above, testing of the relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.

[b] Frequencies are not given, as test methods are not yet available.

[c] ITT, see EN 13172.

[d] Alternatively design values as cited in EN 10456 may be used.

Table I.2 — Minimum product testing frequencies for the reaction to fire characteristics

<table>
<tr><th colspan="2">Clause</th><th colspan="4">Minimum testing frequency [a]</th></tr>
<tr><td>No.</td><td>Title</td><td colspan="2" rowspan="2">Direct testing [b]</td><td colspan="2">Indirect testing [c, d]</td></tr>
<tr><td></td><td>Reaction to fire class</td><td colspan="2">Product</td></tr>
<tr><td></td><td></td><td>Test method</td><td>Frequency</td><td>Test method</td><td>Frequency</td></tr>
<tr><td rowspan="6"></td><td rowspan="4">B
C

D</td><td rowspan="2">EN 13823</td><td rowspan="2">1 per month or
1 per 2 years and indirect testing</td><td>–</td><td>–</td></tr>
<tr><td>Manufacturer to decide on method</td><td>1 per day</td></tr>
<tr><td rowspan="2">and
EN ISO 11925-2</td><td rowspan="2">1 per 2 years and indirect testing
2 years and indirect testing</td><td>–</td><td>–</td></tr>
<tr><td>Manufacturer to decide on method</td><td>1 per day</td></tr>
<tr><td rowspan="2">E</td><td rowspan="2">EN ISO 11925-2</td><td rowspan="2">1 per week or
1 per 2 years and indirect testing</td><td>–</td><td>–</td></tr>
<tr><td>Manufacturer to decide on method</td><td>1 per day</td></tr>
<tr><td>F</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td colspan="6">NOTE Not all Euro classes may apply for the products conforming with this standard.</td></tr>
</table>

[a] The minimum testing frequencies, expressed in test results, shall be understood as the minimum for a product or product group for each production line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.

[b] Direct testing may be conducted by the manufacturer.

[c] Indirect testing may be on the product.

[d] Indirect testing shall be performed in accordance with EN 13172.

Annex J
(normative)

Testing for reaction to fire of products in standardised assemblies simulating end-use application(s)

J.1 Scope

This annex gives basic rules for an additional reaction to fire testing of the products in standardized assemblies simulating end-use applications and provides instructions for mounting and fixing and for the field of application of the test results. These are described in this annex by the term “standard test configuration of assemblies”.

The following is related to 4.3.10 of the product standard.

This annex gives the manufacturer the opportunity to give a complementary and optional declaration (where required) on reaction to fire for a standardized end-use application/assembled system which includes the insulation product.

The Euroclass classification of the product as placed on the market shall always be declared (see Annex C).

J.2 Product and installation parameters

Tables J.1 and J.2 give the parameters that shall be taken into account when determining the reaction to fire performance of standardized assemblies simulating end-use applications (assembled systems) including the thermal insulation product and the field of application of the test results.

The test specimens shall be stored for at least 6 h at (23 ± 5) °C. In case of dispute, they shall be stored at (23 ± 2) °C and (50 ± 5) % RH for 14 days.

Table J.1 — Thermal insulation product parameters

Product parameter	**EN ISO 1182 (Euroclass A1 and A2)**	**EN ISO 1716 (Euroclass A1 and A2)**	**EN 13823 (Euroclass A1 to D)**	**EN ISO 11925-2 (Euroclass B to E)**
All products				
Thickness			X	X
Density	X		X	X
Type of product	X	X	X	X

NOTE Ageing or washing procedures are not applicable for the test specimens.

Table J.2 — Installation parameters

Installation parameter	EN 13823	EN ISO 11925-2
Exposure to thermal attack	X	X
Standardised surface products	X	-
Substrate	X	-
Air gaps/cavities	X	-
Joints/edges of the insulation product	X	-
Joints/edges of the surface product	X	-
Size and positioning of the insulation product	X	-
Product orientation and geometry	X	X
Fixing of the insulation product to the substrate	X	-
Fixing of the insulation product to the surface product	X	-

J.3 Mounting and fixing

J.3.1 Ignitability (EN ISO 11925-2)

J.3.1.1 Exposure to thermal attack

The thermal insulation product shall be tested directly exposed to the thermal attack. The test specimen is submitted to direct flame exposure only on the natural surface. As only one face is exposed to fire in the end application, the exposed face shall be tested.

J.3.1.2 Substrate

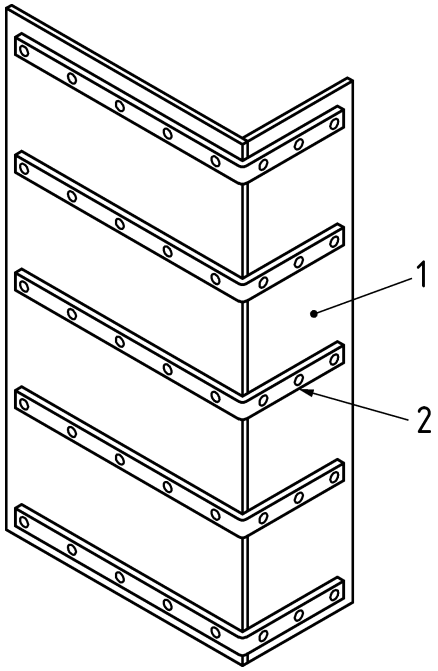
The test specimens shall be mounted in the test apparatus simulating an end-use application.

J.3.2 Single Burning Item [SBI] (EN 13823)

J.3.2.1 Preparation of the test specimens

For products with surface products, if any, subsequently bonded to the natural surface or placed in front of the natural surface in the end-use application, a test specimen shall be prepared by applying onto the internal face of an L-shaped substrate (see Figure J.1) which is prepared by adding externally at least five L-shaped steel brackets to the back of the substrate as shown in Figure J.1. Before testing, bond in place or place in front of the test specimen any surface product.

For test products in which the end-use application requires the surface product to be directly bonded to the applied product during its formation, apply the product directly onto the back of the surface product already prepared in an L-shape with a suitable internal bracket simulating the joint cover plate used in the end-use application.



Key

1 substrate

2 steel brackets (width 30 mm, thickness 5 mm)

Figure J.1 — L-shaped substrate support for the preparation of the test specimen: view of the external surface of the substrate

J.3.2.2 Exposure to thermal attack

Most thermal insulation products will be incorporated into an assembled building system (end-use application) with the thermal insulation product not directly exposed to a heat or fire source. In the case of a standard test configuration of assemblies where the thermal insulation product is directly exposed to a heat or fire source, the standard test configuration of assembly number 1 in Table J.3 shall be followed.

When the product is not directly exposed in end-use application, another product immediately in front, shall be applied so as to simulate the performance of the combination of these products in their end-use application. This product in front is designated as the surface product. Standardized surface products, such as particleboard, steel sheet and plasterboard shall be used (see J.3.2.3).

Table J.3 — Standard test configurations of assemblies

Number	Substrate\ (see J.3.2.4)	Air gap between substrate and insulation product	Insulation product	Surface product (see J.3.2.3)
1	plasterboard	No	X	none
2	plasterboard	No	X	plasterboard
3	none	No	X	corrugated steel
4	particle board	No	X	particle board

J.3.2.3 Surface products

For testing of the assembled systems given in Table J.2, the following products shall be used as surface products:

— Paper faced gypsum plaster board according to EN 520 with a thickness of 9,5 mm, density 600 kg/m^3 and a paper grammage of not more than 220 g/m^2 (CWFT Euroclass A2);

— Particle board non-fire retardant treated according to EN 312 with a thickness of 9 mm to 10 mm and a density of (650 ± 50) kg/m^3 (CWFT Euroclass D);

— Steel sheet with polyester coating (if any) according to EN 508-1 with corrugated profile of 100 mm to 110 mm depth and 250 mm to 275 mm pitch (for example 106/250) and a thickness of (0,75 ± 0,1) mm (CWFT Euroclass A1). The maximum nominal thickness of polyester coating on the exposed face shall be 25 μm with a maximum mass / unit area of 70 gr/m^2 and with a maximum PCS of 1,0 MJ/m^2. On the non exposed face the maximum nominal thickness shall be 15 μm with a maximum PCS of 1,0 MJ/m².

J.3.2.4 Substrate

Test specimens are tested using the standard mounting (see EN 13238 and EN 13823) either with wood-fibre boards, paper-faced plasterboard representing all end-use non-wood based substrates and non-fire retardant treated particleboard representing all end-use wood based substrates.

The test conditions and field of application of the classification shall be given in the declaration of conformity, in the classification report and in the manufacturer's technical literature.

J.3.2.5 Air gaps/cavities

There shall be no air gap between a surface product and the thermal insulation product.

The presence of an air gap between the thermal insulation product and the substrate may have an influence on the reaction to fire performance. If in the end-use application an air gap is used, then an air gap of 40 mm shall be left between the thermal insulation product and the substrate. The air gap shall be ventilated. No air gap shall be left behind the thermal insulation product, if the thermal insulation product is tested behind a surface product of plasterboard or particle board (see Table J.2).

J.3.2.6 Joints/edges

J.3.2.6.1 Joints in surface products

Joints shall be considered as described for fixing of the surface products (see J.3.2.3).

The butt corner joint (if any) shall not be covered with a flashing or a sealant, except for corrugated steel where a flashing is needed.

J.3.2.6.2 Size and positioning of test specimen

The configuration of the test specimen is given in Table J.3.

J.3.2.6.3 Mounting and fixing of the test specimen

J.3.2.6.4 Reporting

The test conditions and field of application of the classification shall be given in the declaration of conformity, in the classification report and in the manufacturer's technical literature.

J.3.2.6.5 Fixing of the thermal insulation product to the substrate

With loose-fill cellulose insulation the product is injected, blown or sprayed in-situ into the test substrate.

J.3.2.6.6 Fixing of the surface product to the thermal insulation product

The method of fixing the surface product is dependent on the nature of the end-use application.

J.4 Field of application

The manufacturer is responsible for the grouping of his products following the rules described in EN 13172 and this standard. The validity of the test results and the field of application for a product group is determined by the product parameters and the installation parameters, which have been taken into account in the testing (see Tables J.4 and J.5).

Table J.4 — Product parameters

Product parameter	Validity of test results			
	EN ISO 1182 Not relevant	EN ISO 1716 Not relevant	EN 13823	EN ISO 11925-2 (Ignitability)
Thickness			Test results are valid for equal or lower thickness	
			Test results on a 180 mm thickness are also valid for higher thickness	Test results on 60 mm thickness are also valid for higher thickness
Density			Product density range as declared by the manufacturer for the end-use application (test at the lowest and highest density in the application range)	

Table J.5 — Installation parameters

Installation parameter	Validity of test results	
	EN 13823 (SBI)	**EN ISO 11925-2 (Ignitability)**
Exposure to thermal attack	**Without surface product (no.1 of Table J.3):** Test result is valid for product applied without surface product (s). The classification obtained is also valid for assemblies when a covering or protecting layer having Euroclass A1 and A2 is placed in front of the thermal insulation product in the end-use. **Plasterboard surface product (no.2 of Table J.3)**: Test results are valid for all non-combustible mineral surface products of Euroclasses A1 and A2 with equal or higher thickness and with equal or higher densities. **Corrugated steel sheet surface product (no.3 of Table J.3)**: Test results are valid for all corrugated steel sheets such as defined in I.3.2.3 and for steel sheets without corrugation or with other type of corrugation and with equal or higher steel thickness. Test results are valid also for other type of organic coating of the steel sheet with equal or lower PCS value and with equal or lower thickness of the coating. **Particle board surface product (no.4 of Table J.3)**: Test results are valid for all types of wooden boards of Euroclass D or higher and with equal or higher thickness and with equal or higher densities.	See J.3.1.1
Substrate	Test results only valid for product applied with the substrate used in the test. For insulation product thickness minimum 80 mm or higher, when testing without surface product or with steel sheet surface product and for any product thickness when testing with plasterboard or particle board as surface product, test result with any substrate is valid for all types of substrate (incl. combustible types, e.g. particle board).	Not relevant
Air gap / cavities	Test results are also valid for larger air gaps. Test results from a test where an air gap has been included are also valid for assemblies without an air gap; for products tested behind the standardized surface products and for products tested without surface products having thickness of minimum 80 mm or higher, test result without air gap is also valid for assemblies with air gap.	Not relevant
Joints of surface product	Test results are valid also for setups without joints.	Not relevant
Edges of surface product	If tested butt jointed with square edges, then valid for all profiled edge finishing.	Not relevant
Fixing of test specimen and surface product	Test results using clamping are valid also for mechanical fixing.	Not relevant

Annex K
(normative)

An example of a performance chart

This is an example for a performance chart which can be adapted for any application.

Different applications may require different classes for settlement. One test result of a product property is the average of the measured values on the number of test specimens given in Table 6 of this European Standard.

The R value is the settled depth of the installed thickness divided by the thermal conductivity value. The manufacturer shall supply the installer with a performance chart.

R value (m^2K/W)	Installed thickness (mm)	Settled Thickness (mm)	No of bags/m2

Annex ZA
(informative)

Clause of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M103[2)] "Thermal insulating products" given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the in situ formed loose-fill cellulose covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

This annex establishes the conditions for the CE marking of the in situ formed loose-fill cellulose intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as the relevant part in Clause 1 of this standard related to the aspect covered by the mandate and is defined by Table ZA.1.

2) As amended.

Table ZA.1 — Relevant clauses

Construction Products: **In situ formed loose-fill cellulose products** Intended uses: **Thermal insulation of building equipment and industrial installations**			
Requirement/Characteristic from the mandate	**Requirement clauses in this European Standard**	**Levels and/or classes**	**Notes**
Reaction to fire	4.2.3 Reaction to fire	Euroclasses	Declared test methods and conditions
Short-term water absorption	4.3.2 Short-term water absorption	–	Classes
Rate of release of dangerous substances	4.3.4 Release of dangerous substances	–	–
Acoustic absorption index	4.3.9 Sound absorption	–	Levels
Thermal resistance	4.2.1 Thermal conductivity and thermal resistance	–	Levels of λ
Water vapour permeability	4.3.3 Water vapour diffusion resistance	–	Levels of equivalent air layer thickness
Direct airborne sound insulation index	4.3.7 Airflow resistivity	–	Levels
Continuous glowing combustion	4.3.8 Continuous glowing combustion	–	–
Durability of reaction to fire against ageing/degradation	4.2.4.2 Durability of reaction to fire against ageing/degradation	–	[a]
Durability of reaction to fire and thermal resistance against biological agents	4.3.6 Mould fungi resistance	-	Declared class
Durability of thermal resistance against ageing/degradation	4.2.4.3 Durability characteristics 4.2.2 Settlement	–	Levels Declared class [b]

[a] The fire performance of loose-fill cellulose does not deteriorate with time. The Euroclass classification of the product is related to the organic content which cannot increase with time.

[b] Thermal conductivity of loose-fill cellulose products does not change with time, experience has shown the fibre structure to be stable and the porosity contains no other gases than atmospheric air.

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, for durability of essential characteristics that have been declared and where the characteristic is subject to a threshold level.

ZA.2 Procedure for attestation of conformity of in situ formed loose-fill cellulose

ZA.2.1 System(s) of attestation of conformity

The systems of attestation of conformity of in situ formed loose-fill cellulose indicated in Table ZA.1, in accordance with the Decision of the European Commission 95/204/EC of 30.04.95 revised by decision 99/91/EC of 25.01.99 and by the Commission Decision 2001/596/EEC and as given in Annex III of the mandate M103 for "thermal insulating product" as amended by mandates M126,M130 and M367, is shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es).

Table ZA.2 — Systems of attestation of conformity

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Thermal insulating products (products intended to be formed in-situ)	For uses subject to regulations on reaction to fire	A1[(1)] ,A2[(1)] ,B[(1)] ,C[(1)] A1[(2)],A2[(2)],B[(2)],C[(2)],D,E (A1 to E)[(3)],F	1 3 4
	Any	-	3
System 1: See Directive 89/106/EEC (CPD) Annex III.2.(i), without audit testing of samples. System 3: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Second possibility. System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility.			
[(1)] Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retarders or a limiting of organic material) [(2)] Products/materials not covered by footnote 1 [(3)] Products/materials that do not require to be tested for reaction to fire e.g. (Products/materials of classes A1 according to the Decision 96/603/EC, as amended).			

The attestation of conformity of the in situ formed loose-fill cellulose in Table ZA.1 shall be according to the evaluation of conformity procedures indicated in Tables ZA.3.1 to ZA.3.2 resulting from application of the clauses of this or other European Standard indicated therein.

Table ZA.3.1 — Assignment of evaluation of conformity tasks in situ formed loose-fill cellulose products under system 1 for products of reaction to fire classes A1[(1)] ,A2[(1)] ,B[(1)] ,C[(1)] and system 3

Tasks		Content of the task	Evaluation of conformity Relevant clauses of EN 13172 and of this standard
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to essential characteristic of Table ZA.1 relevant for the intended use which are declared	Clauses 1 to 5, Annexes B and C of EN 13172:2012 and 7.3 of this standard
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristic of Table ZA.1 relevant for the intended use which are declared	Annex I of this standard
	Initial type testing	Those relevant characteristics of Table ZA.1 not tested by the notified laboratory and notified certification body	Clause 6 of EN 13172:2012 and 7.2,Annex I of this standard
Tasks under responsibility of a notified laboratory	Initial type testing	Thermal resistance Water absorption Settlement Release of dangerous substances [a]	Clause 6 of EN 13172:2012 and 7.2, Annex I of this standard
Tasks under the responsibility of the notified certification body	Initial type testing	Reaction to fire	Clause 6 of EN 13172:2012 and 7.2, Annex I of this standard
	Initial inspection of factory and of FPC	Reaction to fire. Documentation of the FPC.	Annex B and C of EN 13172:2012 and 7.3 of this standard
	Continuous surveillance, assessment and approval of FPC	Reaction to fire	Annex B and C of EN 13172:2012 and 7.3 of this standard

[a] No test method available as yet.

Table ZA.3.2 — Assignment of evaluation of conformity tasks for products under system 3 or system 3 combined with system 4 for reaction to fire

Tasks		Content of the task	Evaluation of conformity clauses of EN 13172 to apply in addition to the relevant Clause 7
Tasks under the responsibility of the manufacturer	Factory production control FPC	Parameters related to all relevant characteristics of Table ZA.1	Clause 7.3 of this standard and Clauses 1 to 5 of EN 13172:2012 and: For system 3 Annex C of EN 13172:2012. For system 3 (with 4 for RtF) Annex C and D of EN 13172:2012
	Initial type testing by the manufacturer	Those relevant characteristics of Table ZA.1 not tested by the notified body including reaction to fire for system 3 and 4	Clause 6 of EN 13172:2012 Clause 7.2, Annex I of this standard
	Initial type testing by a notified test laboratory	— Reaction to fire (system 3) — Thermal resistance a) Water absorption b) Settlement — Release of dangerous substances [a]	Clause 6 of EN 13172:2012 Clause 7.2, Annex I of this standard

[a] No test method available as yet.

ZA.2.2 EC Certificate and Declaration of conformity

In case of products with system 1: When compliance with the conditions of this annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix the CE marking. The certificate shall include:

— name, address and identification number of the certification body;

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

— description of the product (type, identification, use, ..);

— provisions to which the product conforms (i.e. Annex ZA of this European Standard);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

— the number of the certificate;

— conditions of validity of the certificate, where applicable;

— name of, and position held by, the person empowered to sign the certificate.

In case of products under system 3 or (3 with 4 for Rtf): When compliance with the conditions of this annex is achieved, the manufacturer or his agent established in the EEA shall draw up and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 2 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

— description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;

NOTE 3 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this European Standard), and a reference to the ITT report(s) and factory production control records (if appropriate);

— particular conditions applicable to the use of the product, (e.g. provisions for use under certain conditions);

— name and address of the notified laboratory(ies);

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The above mentioned declaration and certificate shall be presented in the language or languages accepted in the Member State in which the product is to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EEC and shall be shown on the in situ formed loose-fill cellulose (or when not possible it may be on the accompanying label, the packaging or on the accompanying commercial documents e.g. a delivery note).

The following information shall accompany the CE marking symbol:

a) identification number of the certification body (only for products under system 1);

b) name or identifying mark of the manufacturer (see Note 1 in ZA.2.2);

c) the last two digits of the year in which the marking is affixed;

d) number of the EC Certificate of conformity or factory production control certificate (if relevant);

e) reference to this European Standard;

f) description of the product;

g) information on those relevant essential characteristics listed in Table ZA.1 which are to be declared presented as standard designation(s) in combination with declared values as described in Clause 6.

NOTE Care needs to be taken that using standard designation does not bring information on non-harmonised characteristics into the CE marking.

The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the product, label, packaging and/or commercial documents.

CE 0123	*CE marking, consisting of the “CE”-symbol given in Directive 93/68/EEC.* *Identification number of the certification body (for products under system1)*
AnyCo Ltd, PO Box 21, B-1050 **13** 0123-CPD-00234	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *EC Certificate of conformity number (where relevant)*
EN 15101-1 In situ formed loose-fill cellulose **Reaction to fire** : A1/s1/d0 **Thermal conductivity** (see Manufacturer’s Literature) **Continuous glowing combustion** :NPD **LFCI – SC1 – WS1 – BA1-AFr1**	*No. of European Standard* *Description of product* *Information on Essential Characteristics* *Designation code (in accordance with Clause 6 of this standard for the relevant characteristics according to Table ZA.1)*

Bibliography

[1] EN 15101-2, *Thermal insulation products for buildings — In-situ formed loose-fill cellulose (LFCI) products — Part 2: Specification for the installed products*

[2] EN ISO 12571, *Hygrothermal performance of building materials and products — Determination of hygroscopic sorption properties (ISO 12571)*

[3] EN 13171:2012, *Thermal insulation products for buildings — Factory made wood fibre (WF) products — Specification*

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